PAGE 7/30 * RCVD AT 8/2/2007 4:26:55 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-2/0 * DNIS:2738300 * CSID:450 435 3025 * DURATION (mm-ss):09-44

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Amendments to the Specification:

Please delete paragraph **[0004.A]**, **[0014.A]**, **[0014.B]**, **[0014.C]**, **[0014.D]**, **[0014.E]**, **[0014.F]**, **[0014.G]**, **[0014.H]**, **[0014.I]**, **[0014.J]**, **[0014.K]**, **[0014.L]**, **[0014.M]**, **[0014.N]**, **[0016]**, **[0016.A]**, **[0016.B]**, **[0016.C]**, **[0016.D]**, **[0029.A]**, **[0030.A]**, **[0032.A]**, **[0032.B]**, **[0032.C]**, **[0032.D]**, **[0032.E]**, **[0043.A]**, **[0044.A]**, **[0044.B]**, **[0044.C]**, **[0074.A]**.

Please replace paragraphs **[0002]**, **[0004]**, **[0007]**, **[0008]**, **[0009]**, **[0010]**, **[0013]**, **[0015]**, **[0017]**, **[0030]**, **[0032]**, **[0044]**, **[0046]**, **[0055]**, **[0056]**, **[0057]**, **[0065]**, **[0066]**, **[0067]**, **[0069]**, **[0070]**, **[0071]**, **[0072]**, **[0074]**, **[0075]**, **[0076]**, **[0077]**, **[0078]**, **[0080]**, **[0081]**, **[0082]**, **[0083]**, **[0085]**, **[0086]**, **[0087]**, with the following amended paragraphs:

[0002] The present invention generally relates to the separation and mixing ~~treating~~, of particles and, more specifically, to a dry particle stream separator/mixer ~~treatment system~~ and methods for separating particle streams into particle groups and for mixing/treating particle groups ~~streams~~.

[0004] Another known separation method is gravity separation by elutriation. In this process, a predetermined particle group is lifted by airflow against the force of gravity. A finer particle group is collected by an upwardly positioned collector, whereas coarser particles overcome the airflow to be collected at a downwardly positioned collector. The ~~amount and~~ velocity of air has a direct effect on the particle group that is collected by the upwardly positioned collector.

[0007] It is a further aim of the present invention to cause a dilution of a particle stream and is related to enhance the separation of the particle stream ~~components having different masses,~~ into particle groups.

[0008] It is a further aim of the present invention to provide a novel apparatus and method for mixing ~~treating~~ a particle groups into a particle stream.

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[0009] It is a further aim of the present invention ~~is related to an apparatus~~ that the apparatuses for separating a particle stream into particle groups, and for mixing ~~treating~~ particle groups into a particle stream use minimum space and ~~fluid~~ air volume so as to be cost and space efficient.

[0013] A few factors are considered in creating separation, mixing ~~treating~~ equipment. For instance, it is desired that the amount of fluid used in the process be kept low. The fluid that is used for the separation, will lose the particles ~~depending of the momentum of the fluid flow~~ it carries ~~in suspension~~ for settling.

[0015] Therefore, and non-restrictively, in accordance with the present invention, there is provided an apparatus for separating a particle stream into particle groups and treating a particles stream. The apparatus includes a dilution treatment chamber 12, defining for instance a parallelepipedic upstanding passageway (20), dilution treatment chamber 12, having a particle inlet 21, at a top end, and a first-particle group outlet at a bottom end, the dilution treatment chamber 12, being adapted to receive a particle stream at the inlet 21, such that the particle stream falls toward the dilution treatment chamber and first particle group outlet 22; a transfer chamber casing 13, for instance parallelepipedic and adjacent to the dilution treatment chamber 12, and defining a transfer chamber 30, adapted to receive the second particle group separated from the particle stream; a transfer chamber 13, sharing a wall 23, with the dilution treatment chamber 12; at least one transfer aperture 24, second particle group outlet laterally positioned with respect to the dilution treatment chamber 12, and allowing fluid communication between the longitudinal dilution treatment chamber 12, and the longitudinal transfer chamber 13; a distributor 14, in passageway of the dilution treatment chamber 12, and at least one nozzle 14, ~~for creating the impact force produce by the pressure of the fluid~~ situated between the particle stream inlet 25, and at least one transfer aperture 24, second particle-group outlet for spread out, breaking down the particle stream and distributing the particle stream over a surface area of the dilution treatment chamber 12, and; at least one dilution treatment chamber fluid flow aperture

(25) in the dilution treatment chamber 12, and below the distributor 14, adapted to create a lateral fluid flow jet between the dilution treatment chamber 12, and the transfer chamber 13, so as to impact and entrain a second particle group, from the passageway of the dilution treatment chamber and to project the selected particles groups away through the transfer aperture 24, and second-particle group outlet to the transfer chamber outlet 31, with a first-particle-group remaining in the dilution treatment chamber 12, and exiting through the dilution treatment chamber, first-particle-group outlet 22, the apparatus being adapted to be connected to a positive pressure source to create the ~~rate and pressure of the~~ fluid flow stream.

[0017] Still further in accordance with the present invention, there is provided an apparatus for at least treating particle and/or fluid stream, comprising a generally parallelepipedic dilution treatment chamber 12, defining a parallelepipedic upstanding passageway 20, having an inlet 21, at a top end, and an outlet 22, at a bottom end, the passageway 20, being adapted to receive said particle and/or fluid streams at the inlet such that said particle and/or streams fall toward the outlet; at least one dilution treatment chamber fluid flow aperture 25 connected to the nozzle outlet having an adjustable cross section area, in the dilution treatment chamber 12, adapted to create a generally lateral flow of at least one of a fluid jet and particle jet ~~defined as a free jet fluid leaving an outlet will expand and decelerate. The jet momentum is transferred to the particles stream and the distance of deceleration depend of the cross section area and the magnitude of the jet leaving the nozzle~~ within the passageway 20, enhancing separation and to create a turbulence in the passageway 20, for at least one of mixing said particle and/or fluid streams and treating said particle and/or fluid streams, whereby a mixture and/or treated matter will exit the passageway 20, at the outlet 22; and a positive pressure source connected to the nozzle which is connected to the dilution treatment chamber fluid flow aperture to create the lateral flow of the at least one of the fluid and the particle jet ~~having a high pressure~~.

[0030] It is pointed out that the present invention is associated with the separating or mixing ~~treating, or any combination thereof, the of different components having different properties of a~~ particles~~-stream.~~ ~~For example, the components have different masses.~~ The term "particles stream" is broadly used herein to designate a different component mass of particles, granules, pellets, and other elements of different mass and volume gathered together. Various uses of the present invention are defined hereinafter, for which the components masses ~~that~~ which are ~~is~~ separated/~~mixed~~/treated is referred to as particle stream, unless stated otherwise.

[0032] The dilution treatment chamber 12 performs a dilution of a particle stream by ~~producing space between the different component gathered together in the particle stream using pressure of the fluid. The fluid flow is a fluid that is involved in the separation or treating particles stream. The magnitude of the force is created by the pressure of the fluid jet. More specifically, the force creates a momentum in the jet stream which is transferred in part on the particles stream. In some embodiments of the invention, the pressure of the fluid creates a relatively large distance between the particles and distribute in the volume of the dilution treatment chamber. The extent to which the particles stream are diluted on many parameters. For example, the following parameters influence the dilution: 1) adjustment of the surface area of the dilution treatment chamber12; 2) adjustment of the fluid jet magnitude; 3) number of stage of projection of the fluid jet; 4) length of the dilution treatment chamber 12, among others. All these parameters determine the dilution rate of the particle stream masses. The fluid jet injection trough the dilution treatment chamber and the speed acceleration by the~~ gravity ~~force of the particle stream~~, and hosts a step of separation/~~treating~~ of the particle stream into particle groups. ~~As described~~;

[0044] The above-described configuration of the nozzle 14 enables a high-pressure, low-volume output of gaseous fluid into the dilution treatment chamber 12 to produce a high impact on the particles stream ~~for projecting the particles at different distances depending of their masses and momentum and other characteristics~~.

[0046] In a preferred embodiment of the present invention, the pre-treatment module 15 has a slide 50, sloping downwardly towards the inlet 21 of the dilution treatment chamber 12. A deflector 51 is positioned between the slide 50 and the inlet 21 of the passageway 20. The deflector 51 has a generally horizontal launch surface, but may also be oriented otherwise. As seen in Figs. 2 and 3, the slide 50 tapers towards the inlet 21 of the dilution treatment chamber 12, so as to have an outlet 22, width generally equal to the inlet 21, width of the passageway 20 of the dilution treatment chamber 12. The particle stream reaching the slide 50 is preferably uniformly distributed toward the inlet 21 of the dilution treatment chamber 12.

[0055] A first one of the nozzles 14, namely nozzle 14A, will inject/~~project~~ air ~~fluid~~ within the dilution-treatment chamber 12, passageway 20, so as to spread out the mass of particle stream into particle groups, dilute and/or creating space between the particles groups. This nozzle 14A is also referred to as a distributor, as it will be distributing the particle stream over a surface area of the dilution treatment chamber dimension 12. As an alternative of nozzle 14, a distributors 14, the apparatus 10 may be provided with vibrating strainers, impellers, or the like, as will be illustrated hereinafter.

[0056] The particle stream, having been subjected to a horizontal and a vertical dilution, will be crossing a horizontal flow of air ~~fluid jet substantially perpendicular to the particle stream in said falling direction~~ as injected/~~projected~~ by at least one others nozzles 14B, and the optional nozzle 14C. The nozzles 14B and 14C inject ~~project~~ air ~~fluid~~, at a predetermined pressure through the dilution treatment chamber fluid aperture 25, which are positioned opposite to the transfer chamber aperture 24, such that the fluid ~~air~~ will project particles group selected from the particle stream in the dilution treatment chamber 12 the finer particles carried through the particle stream and/or out of the ~~channel~~ passageway 20, through the transfer chamber aperture 24, and into the inner transfer chamber 13, in a high ratio of particle to air ~~fluid~~ concentration. The ~~projected fluid~~ air injected by the nozzles 14 is at the predetermined pressure, such that the other groups of

particles have not been projected out and remain in the particle stream depending. In other words, some groups of particles are projected over the dilution treatment chamber distance, which creates a separation of these groups of particles from other particles present in the stream of particles. Particle group will not entrained out of the passageway 20 by the air ~~fluid~~ flow. The dilution that has taken place previously is an important factor for the separation and treating of the different particles. The ~~-~~magnitude of the pressure of ~~fluid~~ air projected/injected will have a direct effect on the particles groups being withdrawn from the particle stream in the dilution treatment chamber 20. It is pointed out that the vertical distance from the inlet 21 to the nozzle 14B is an essential factor in diluting the particle stream to facilitate the subsequent separation/treating of the particle groups so as to increase fluid/particle contact.

[0057] Although ~~plurality of~~ three nozzles (namely 14A, 14B and 14C) are described, the number of nozzles 14 is variable according to the present invention. The apparatus 10 is operative with a single nozzle 14 opposing ~~connected to~~ an aperture 25, but a plurality of nozzles 14 may be serially added on the dilution treatment chamber 12 to increase the efficiency of the operation taking place within the dilution treatment chamber 12.

[0065] A first one of the nozzles, namely nozzle 14A, will laterally project/inject fluid, or any other suitable fluid or particle jet, within the ~~channel~~ passageway 20 of the dilution treatment chamber 12 so as to cause a ~~turbulence~~ movement of components of particle stream for another step of dilution ~~a mix or a treatment~~ of the particle and/or fluid streams. The fluid/particle injected and projected by the nozzle 14A is of predetermined pressure depending of the adjustment of the pressure source and the nozzle outlet gate 41, to produce the different jet force through the particle stream so as to have a variable effect relative to the size, mass and other characteristics of the particles and/or fluid streams. The nozzle 14 and 14A projects/injects air or any other suitable fluid, at high pressure and low volume.

[0066] The opposite transfer chamber apertures ~~lateral outlets~~ 24 are used in the ~~mixing~~ treating process of the apparatus 10. The nozzles 14B and 14C are optionally used with the opposite transfer chamber aperture ~~lateral outlets~~ 24 ~~being blocked~~ with a fluid at high pressure 26, so as to create further turbulence, as it is contemplated to provide a plurality of the nozzles 14 to enhance the ~~mixing~~ treating of particle and/or fluid stream in the passageway ~~channel~~ 20, or for treating the particle and/or fluid streams. Additional nozzles may also be added to the apparatus 10.

[0067] Thereafter, the ~~mix or~~ treated matter, resulting from the ~~mix/~~treatment of the particle and/or fluid streams, continues its drop into the dilution treatment chamber 12 toward the outlet 22.

[0069] Referring to Figs. 5 and 6, a lateral ~~distributor~~ selector is generally shown at 60. The lateral ~~distributor~~ selector 60 is positioned in the transfer chamber 30 of the transfer casing 13. Referring more specifically to Fig. 6 in which all reference numerals are shown to simplify Fig. 5, the lateral ~~distributor~~ selector 60 is shown defining three upstanding sectors 61, each converging to a segmented outlet portion 62. Each of the sector 61 has a respective collecting surface 63 upon which particles coming from the dilution treatment chamber 12 will be collected. A flow of fluid outlet 64 is provided downstream of the upstanding sectors 61 to allow an appropriate flow of fluid, that will not impede on the lateral flow of fluid (or gaseous fluid) out of the lateral outlets 24 of the dilution treatment chamber 12.

[0070] More specifically, the lateral distributor 60 operates with the principle that the distance traveled by the particles transported ~~carried~~ in the flow of ~~air~~ fluid from the dilution treatment chamber 12 is a function of the particle size parameters (e.g., surface area, mass)and the jet momentum of the flow of fluid. Accordingly, ~~coarser~~ heavier mass of particles will travel a shorter distance than finer ones, whereby the coarser particles will be collected by the upstream sector 61. Therefore, a further particle group separation takes place with the lateral distributor 60. The hence separated particle groups are collected-separately at the segmented outlet portion 62.

[0071] Referring to Figs. 3 and 7, recuperation trays 70 are provided below each of the transfer chamber apertures ~~lateral outlets~~ 24 of the dilution treatment chamber 12. More specifically, it is possible that particles groups ~~that~~ should selectively remain with the dilution treatment chamber 12 are deflected out of the transfer chamber aperture ~~lateral outlets~~ 24. It is anticipated that these ~~coarser~~ heavier groups of particles will not travel a long distance out of the transfer chamber aperture ~~lateral outlets~~ 24 due to their ~~size~~ mass parameters and momentum. Accordingly, the recuperation trays 70 are provided to collect these particles, as they are positioned directly below the transfer chamber apertures 24. These particles are returned to the dilution treatment chamber 12 by the sloping shape of the recuperation trays 70.

[0072] Moreover, the recuperation tray 70 illustrated in Fig. 7 have various configurations also effects a particle separation. More specifically, the recuperation tray 70 ~~as~~ has a first sector 71 and a second sector 72. The first sector 71 collects the particles that should not have left the dilution treatment chamber 12, whereas the second sector 72 collects rapidly falling particles, of a grade just below that of the particle group remaining within the dilution treatment chamber 12. It is pointed out that the second sector 72 is connected to its own outlet.

[0074] Fig. ~~12~~ 8 and ~~13~~ 9 illustrate alternative ~~to~~ of the nozzle 14A ~~for use in the dilution process~~. In Fig. 8, an impeller is shown at 80. In Fig. 9, a laterally reciprocating strainer is generally shown at 90. Both these alternatives will cause a horizontal dilution of the particle stream. Other alternatives include ~~fans~~, electrostatic or magnetic emitters (e.g., in accordance with the type of particles stream being treated), as well as any mechanical or ultrasound system.

[0075] It is also contemplated to inject additives to the particle stream being diluted in the dilution treatment chamber 12. For instance, an aperture such as one of the dilution treatment chamber pressure-differential apertures 25 can be used with a suitable injection system (e.g., ~~blower~~ pressure source and conduit combination) to inject any kind of

treatment agent color (e.g., in the form of a powder) to the particle stream being diluted in the dilution treatment chamber 12, or to particle groups being ~~mixed~~ treated therein.

[00076 It is also contemplated to provide a plurality of the apparatus 10 in series, with a conveying system transporting/conveying the output of an upstream one of the apparatus 10 to a downstream one. Alternatively, a pair (or more) of the apparatus 10 may be positioned in parallel and/or share a common transfer chamber 30, to collect a specific particle group. In such a case, the transfer chamber 13 could be used to ~~mix~~ treat a particles group from a first dilution treatment chamber 12 with particles group of a second dilution treatment chamber 12.

[0077] For instance, referring to Fig. 10, an apparatus in accordance with an alternative embodiment of the present invention is generally shown at 10'. The apparatus 10' is similar to the apparatus 10 of Fig. 1 in that the apparatus 10' has a dilution treatment chamber 12,102, nozzles 14, 104 (herein ~~four~~ pluralities nozzles for the dilution treatment chamber 12,102), and a pre-treatment module 15'. The pre-treatment module 15' shows a different shape (e.g., with a ~~conical~~ slide ~~53~~'55', but operates in a fashion similar to that of the pre-treatment module 15. The apparatus 10' has an other transfer chamber casing 13' in which a secondary separation/treatment is performed.

[0078] More specifically, the transfer chamber casing 13' has a transfer plate 100, a dilution treatment chamber 102, nozzles 104, and another transfer chamber sub casing 106. The particles group reaching the transfer chamber casing 13' from the dilution treatment chamber 12 will drop into the inlet of the dilution treatment chamber 102, or will settle onto the transfer plate 100, to then reach the inlet of the dilution treatment chamber 102.

[0080] The dilution treatment chamber 102 is illustrated having the nozzles 104A, 104B, and 104C. The nozzle 104A serves the same function as the nozzle 14A of Fig. 1, namely to distribute ~~break down~~ the particles group that has reached the dilution treatment chamber 102. The nozzle 104A can be replaced with other devices, such as those illustrated in Figs. ~~12~~ 8 and ~~13~~ 9.

[0081] The nozzles 104B and 104C serve the same function as the nozzles 14B and 14C of Fig. 1, and are thus positioned opposite the transfer aperture ~~lateral outlets~~ 110, through which a particle group will be forced out, to reach the transfer chamber sub casing 106 and settle therein. The removed particles group will exit through outlet 112, whereas the remaining particles group in the dilution treatment chamber 102 will exit through dilution treatment chamber outlet 114. Recuperation trays 116 are adjustable similarly to the recuperation trays 70 of the preferred embodiment.

[0082] Accordingly, the output of the apparatus 10' ~~are~~ have many ~~is three~~ particles groups, with particles group exiting from the passageway outlet 20, 102, and transfer chamber outlet 112 ~~sub-casing 106 being the finest~~. It is pointed out that the gaseous fluid magnitude output ~~of~~ at the nozzles 14 and 104 is adjusted in view of the desired ~~size~~ mass of the particles groups. The transfer chamber casing 13' can be used for separating/ ~~mixing or~~ treating, as described previously for the apparatus 10.

[0083] Amongst the various process that can take place with the apparatus (10-10') of the present invention, it is contemplated to separate, treat, classify (with an initial step of separation), ~~mix~~, add, vaporize, clean, calibrate, or eliminate group of fines particles from particle streams. Other treatments, such as painting, coating, sandblasting, ~~or~~ cleaning, and so forth can be effected with the apparatus 10-10' of the present invention. Existing batch processes, such as the injection of gas or chemicals into soft drinks, can be converted to continuous processes using the present invention.

[0085] The apparatus 10-10' can be used with mineral, vegetable, biological, or organic aggregates, as well as with fertilizers, treatment or transformation residues, waste, food products, drugs and other pharmaceutical products, powders, agriculture related products, chemical or metallurgical products, compost, plastics and composites, paper, soil and bio-soil, ashes, crushed stone, ceramics, coal.

[0086] The apparatus 10-10' of the present invention is relatively small. Accordingly, it is possible to place the apparatus 10-10' at various parts of a process due to these advantageous features. The apparatus 10-10' enables large quantities of

particle fluid streams to be treated in a relatively limited amount of space, with little wear of material, low energy consumption and, in some embodiments, no moving parts (i.e., depending on the choice of the type of dilution).

[0087] The apparatus 10-10' can be used as part of a multi-step or multi-pass process. ~~Moreover although,~~ For instance, the preferred embodiment includes ~~only~~ a settling cavity for the collection of particles~~, an outflow of air for the particles remaining in suspension can be added as an option~~. The apparatus 10-10' is made of rigid materials, such as metals, polymers, and so forth. It is pointed out that aside from the slide 53, the apparatus 10-10' goes through limited wear.